

Utah Lake Mass Balance Update



UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
**WATER
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Science Panel Meeting #6
December 11, 2019
Scott Daly

Background

Previous Mass Balance Estimates

- Psomas, 2007
- Merritt and Miller, 2016
- Merritt, 2019

Goal

- Update the Utah Lake nutrient mass balance with contemporary data
 - WWTP inputs
 - Stream inputs and outputs
- Estimate inputs from agricultural and stormwater
- Evaluate ungaged inflows

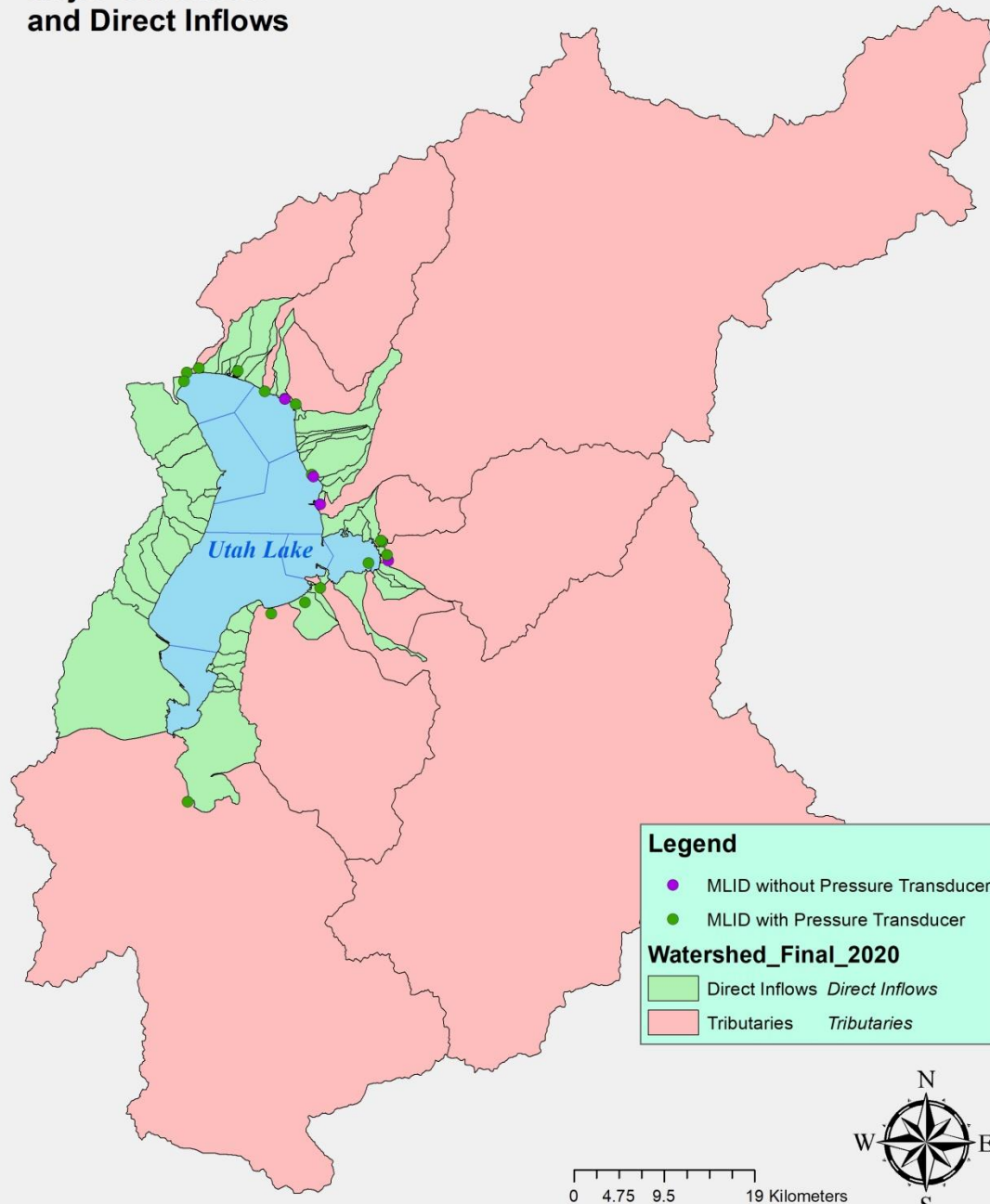
Data Compilation

Data Sources

- EPA Water Quality Portal (WQP)
 - DWQ
 - WFWQC
 - UVU
 - BYU
- USGS NWIS
- EPA Enforcement and Compliance History Online (ECHO)
- LKSIM (Dr. Merritt)

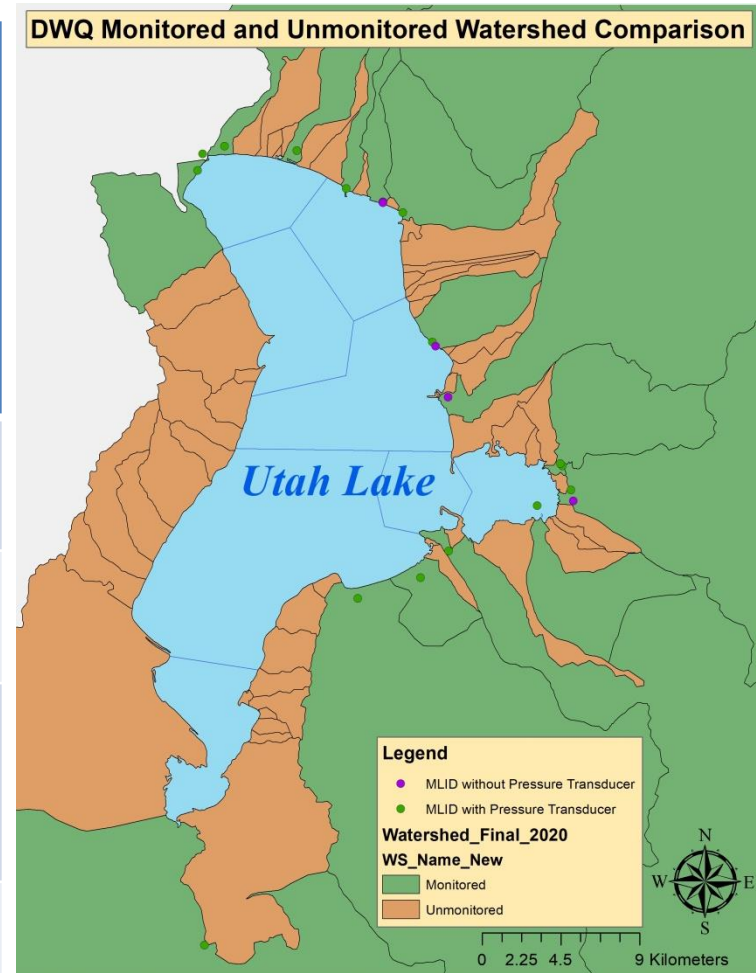


Utah Lake Watershed Boundary: Major Tributaries and Direct Inflows

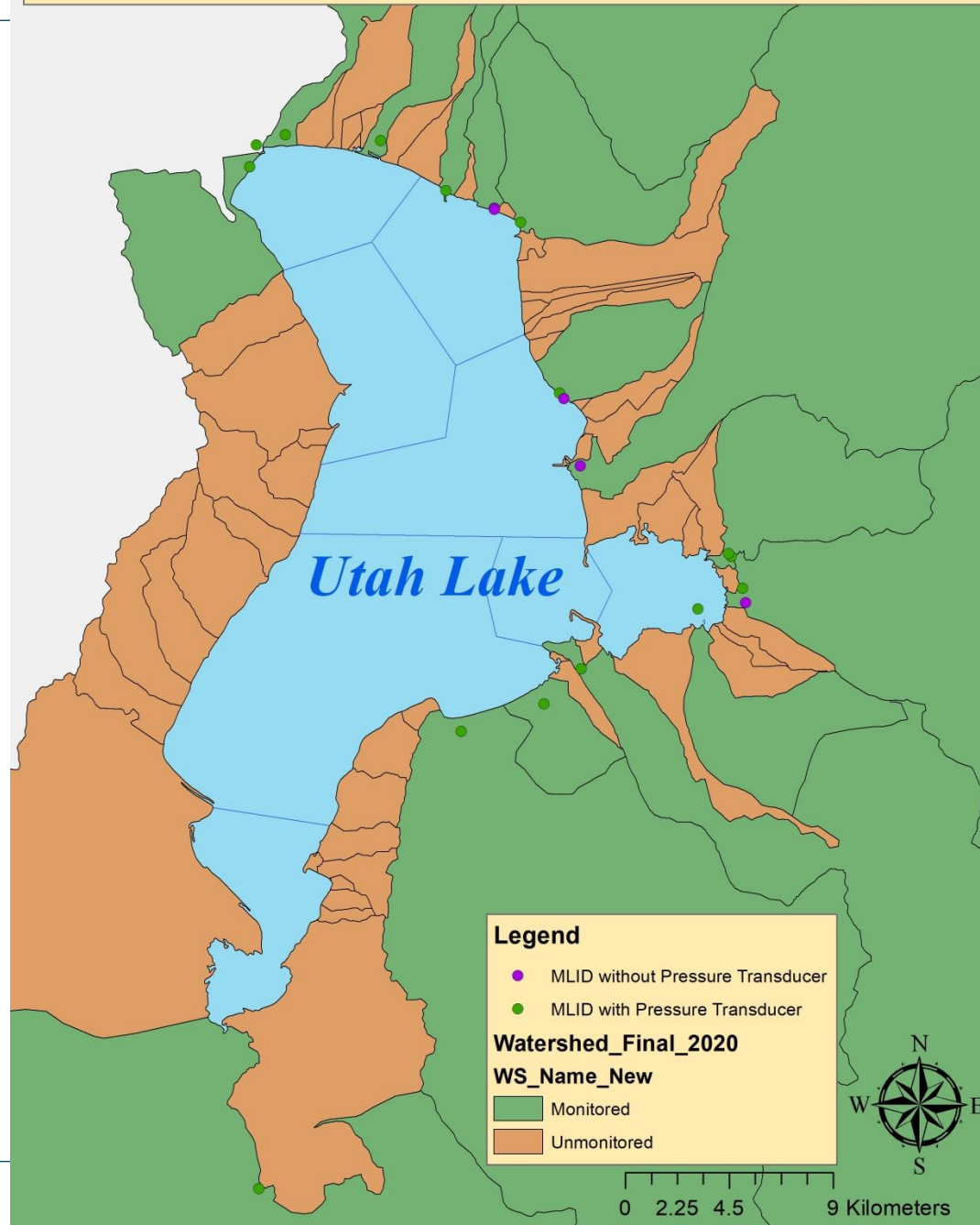


Monitored Watersheds

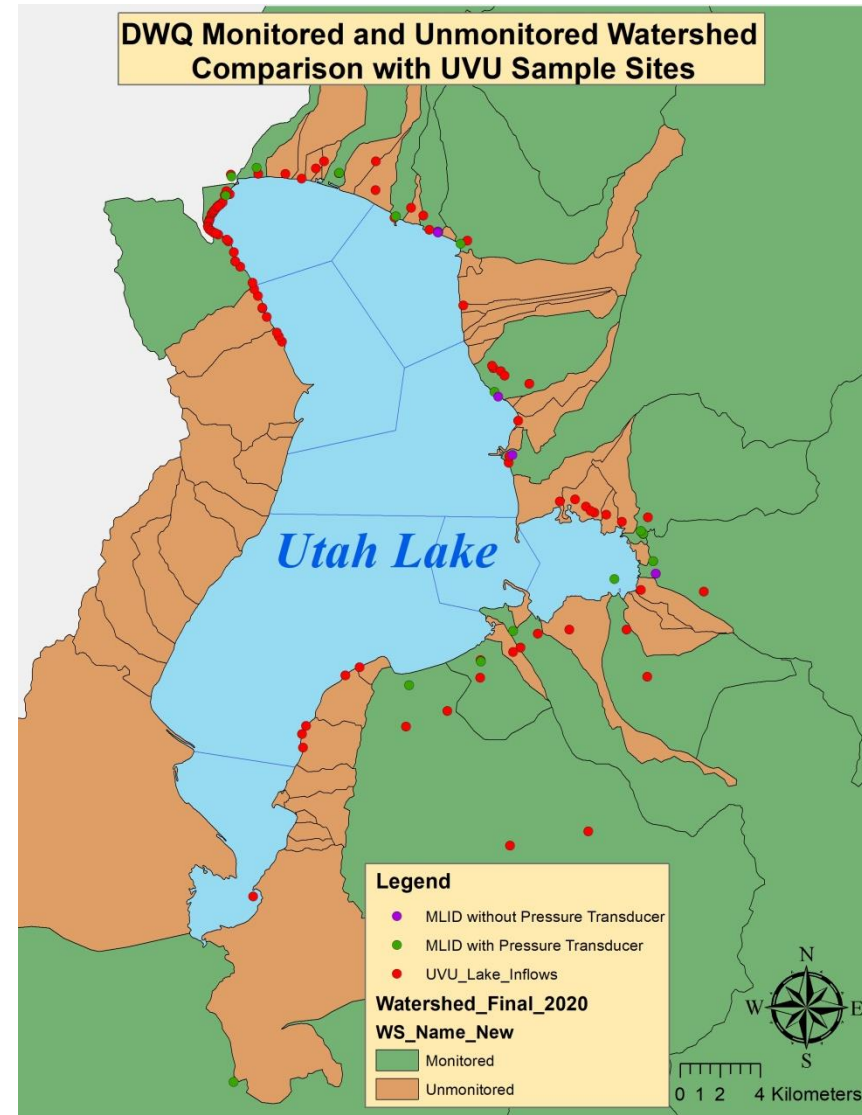
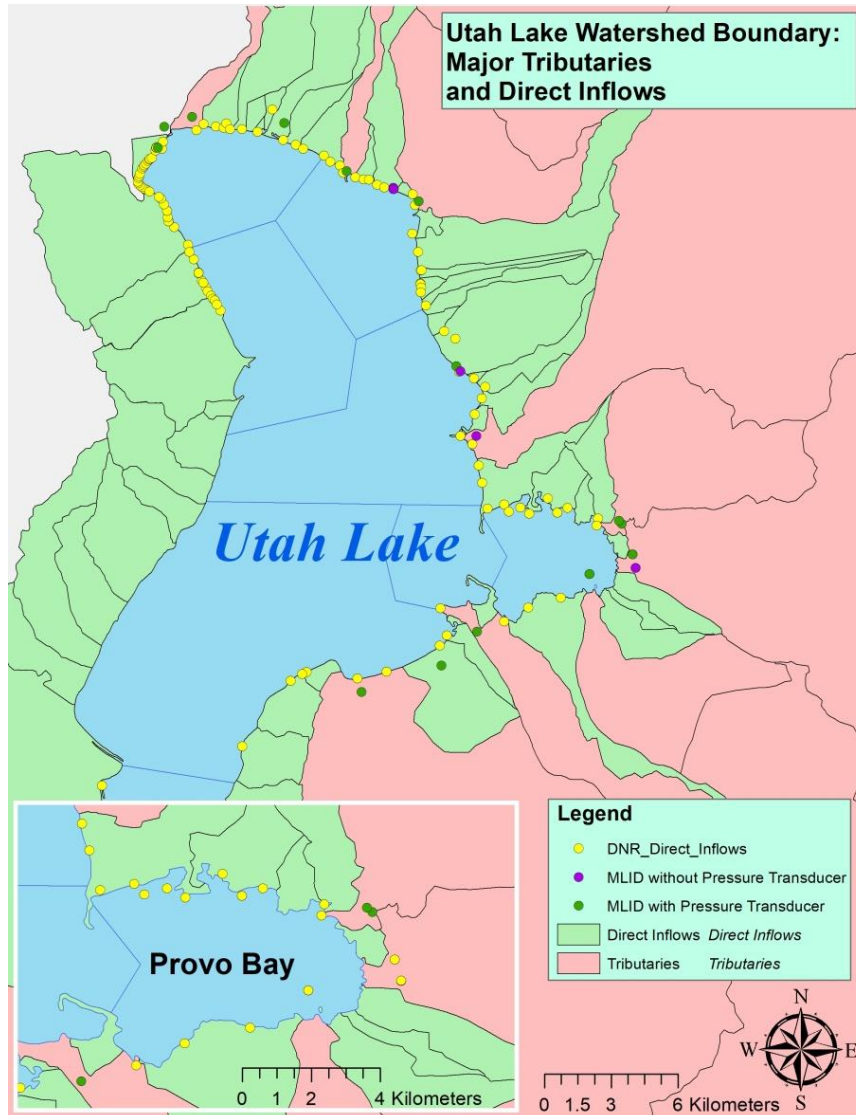
69 Total Watersheds	Area km ² (% of Watershed Total)	Area Monitored (Relative %)
Major Tributaries	5,885 (91.4%)	5,885 (100 %)
Direct Drainages	557 (8.6%)	89 (16%)
Major Tribs + Direct Drainages	6,442 (100%)	5,974 (92.7%)
Inflow Recon	6,337 (98.4 %)	--
Total Watershed Area	6,442	



DWQ Monitored and Unmonitored Watershed Comparison



Direct Drainage Inventory



Tier 1 Methodology



Tier 1 Methodology

Objective

- Develop monthly mass balance for comparison to previous studies

Approach

- Estimate average monthly flow, concentration and load
 - Gaged inflows
 - WWTPs
 - Springs
 - Groundwater
 - Precipitation
- Ungaged inflows
 - Regional estimates for precipitation and runoff
 - Land cover based concentration estimates
- Compare results to previous studies
- Compare to LKSIM results

Tier 2 Methodology



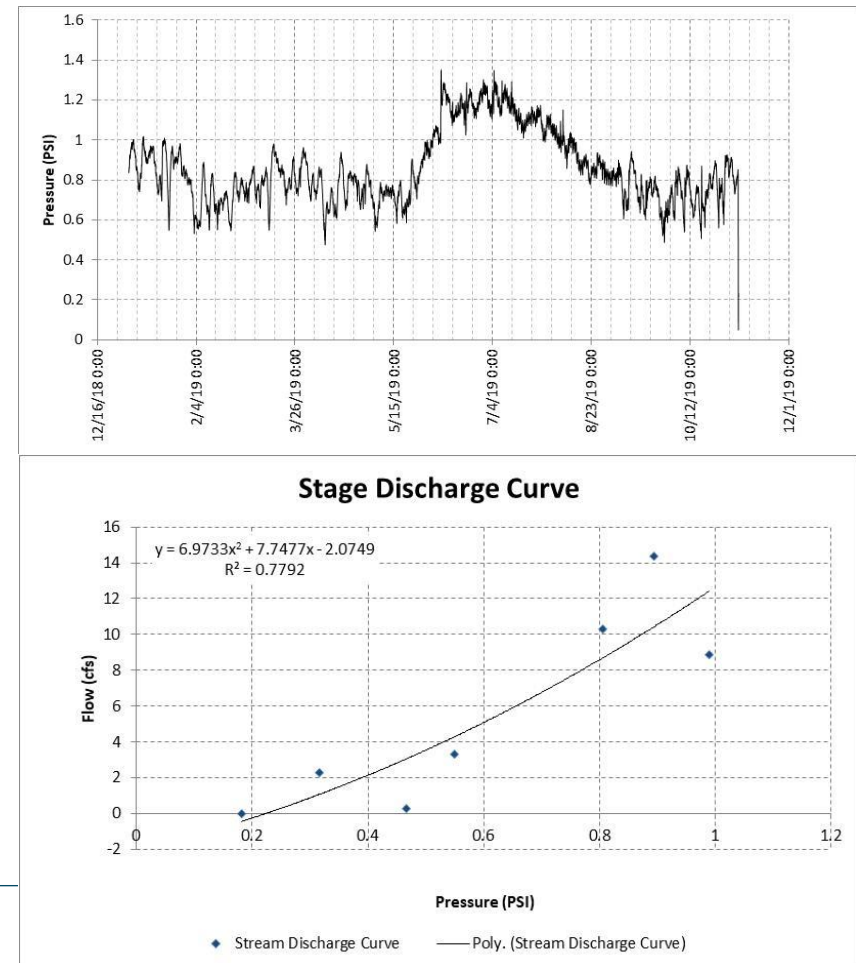
Tier 2 Methodology

Objective

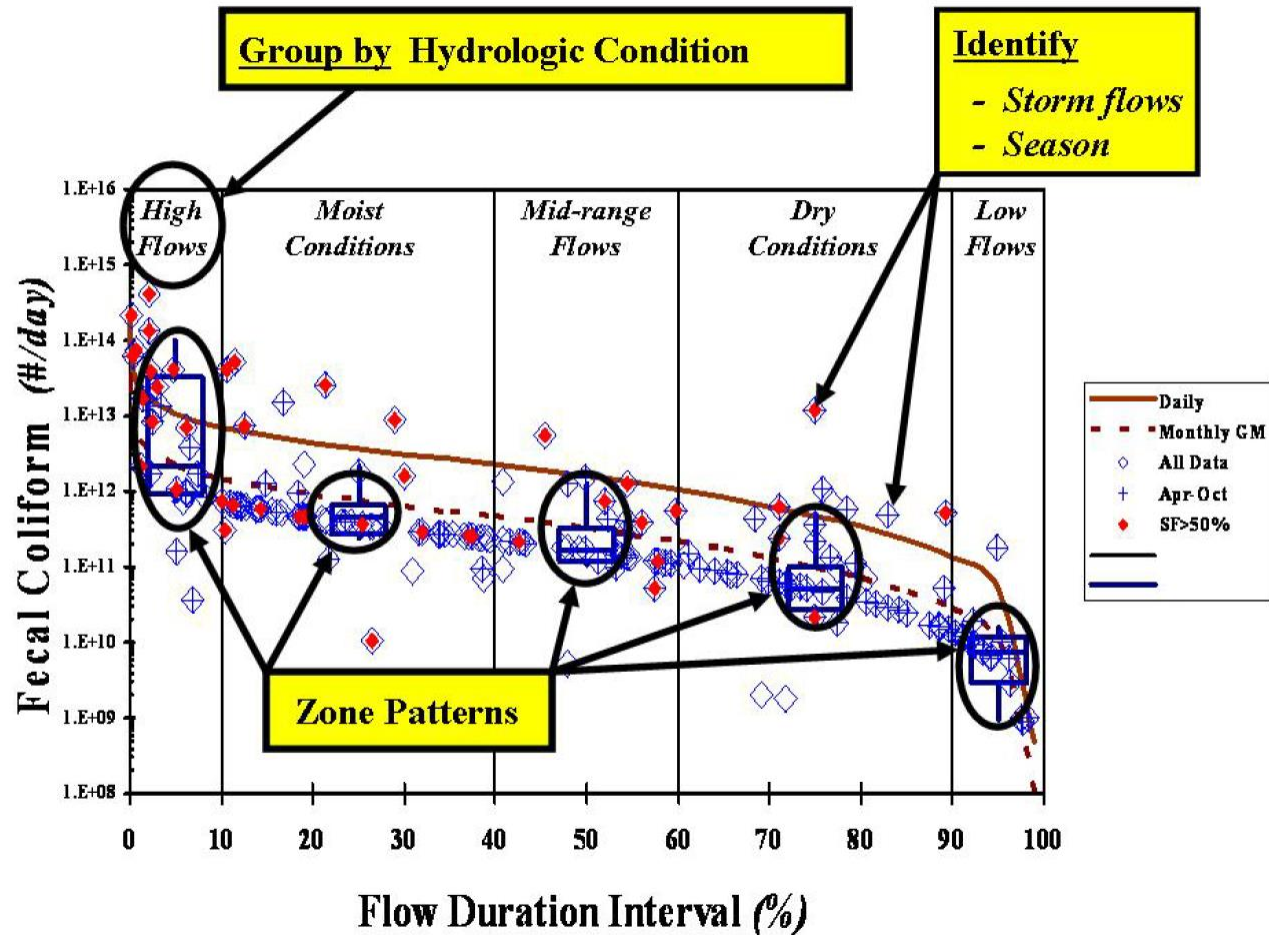
- Use recent high frequency discharge to refine Tier 1 results
- Estimate stormwater loading
- Estimate nutrient attenuation

Approach

- Develop stage discharge curves
- Define and identify stormwater conditions
 - Load duration curves
- Assign representative stormwater concentrations from existing dataset
- Conservative tracers (Cl⁻)
- Longitudinal stream profile



Load Duration Curves



EPA, 2007. An Approach for Using Load Duration Curves in the Development of TMDLs

Tier 3 Methodology



Tier 3 Methodology

Objective

- Develop boundary condition time series loading for lake model input

Approach

- USGS Load Estimator (LOADEST)
- USGS Exploration and Graphics for River Trends (EGRET)
- Weighted Regression on Time, Discharge, and Season (WRTDS)
- SPARROW

Discussion

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